Loadings of Toxic Contaminants to South Puget Sound

Scott Redman
Puget Sound Partnership Staff

March 26, 2008

Outline

- Harms and threats from toxic contaminants in Puget Sound
- Pathways & sources of toxic chemicals
  - Conceptual model
  - Phase 1 characterization
  - People for Puget Sound review of point sources
- Strategies and programs for addressing sources and pathways

Persistent, bioaccumulative toxins

- PBTs of concern in Puget Sound include:
  - Halogenated hydrocarbons such as
    - PCBs
    - chlorinated dioxins & furans
    - PBDEs
    - DDT
  - PAHs
  - Methylmercury
  - Lead

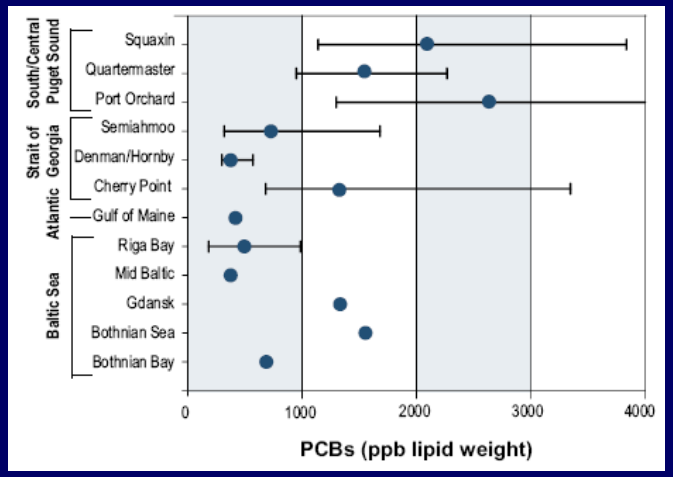
Other toxins of concern in Puget Sound

- Phthalates
- Current use pesticides
- Copper
- Arsenic
- Cadmium
- Other endocrine disruptors, such as
  - Synthetic estrogens
  - Nonyl phenol
  - Bisphenol A

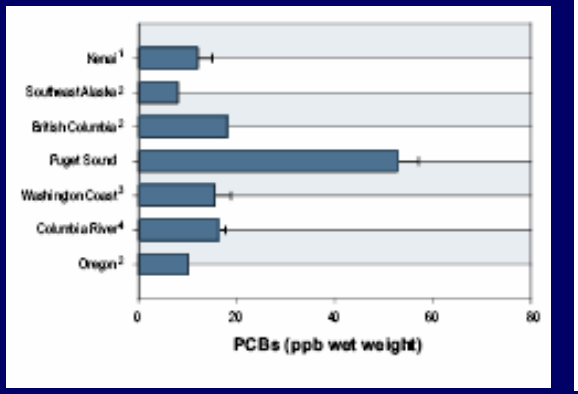
PBTs in Puget Sound fish and wildlife

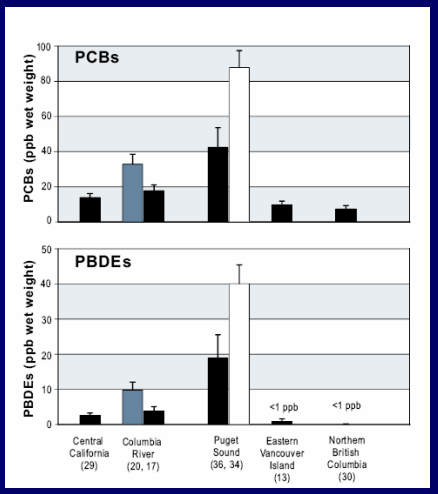
WDFW & DFO data reported in 2007 PS Update

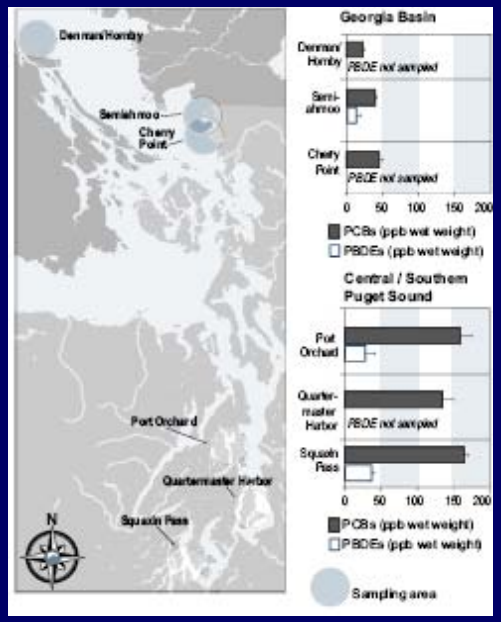
Herring



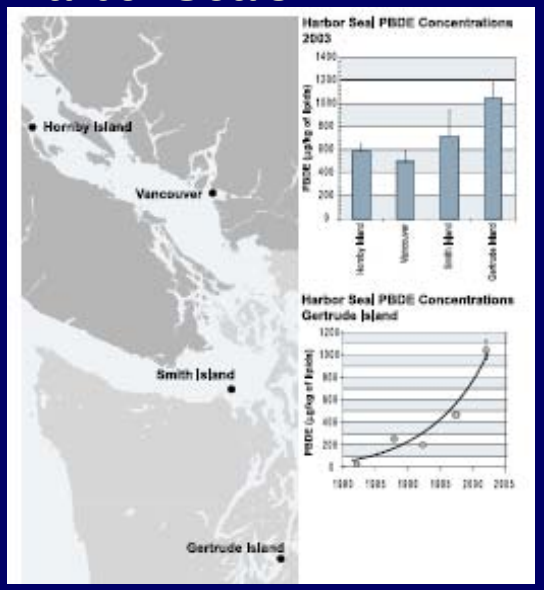
Chinook



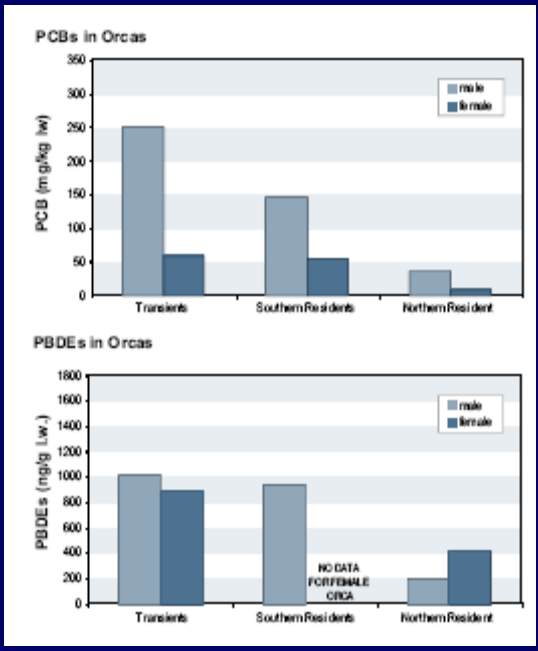




Harbor Seals



Orcas



Fish and wildlife harm from PBTs

- Liver lesions and reproductive impairment in English sole from urban bays
  - *WDFW & NWFSC studies suggest harm from PAHs, PCBs, unknown hormone disruptors*
- Immune suppression in salmon migrating out of urban estuaries and in marine mammals
  - *NWFSC, WDFW & DFO studies suggest harm from organochlorines*
- Suspected impaired development, growth, and reproduction; altered behavior; and cancer in birds
  - *CWS and USFWS studies suggest harm from organochlorines*

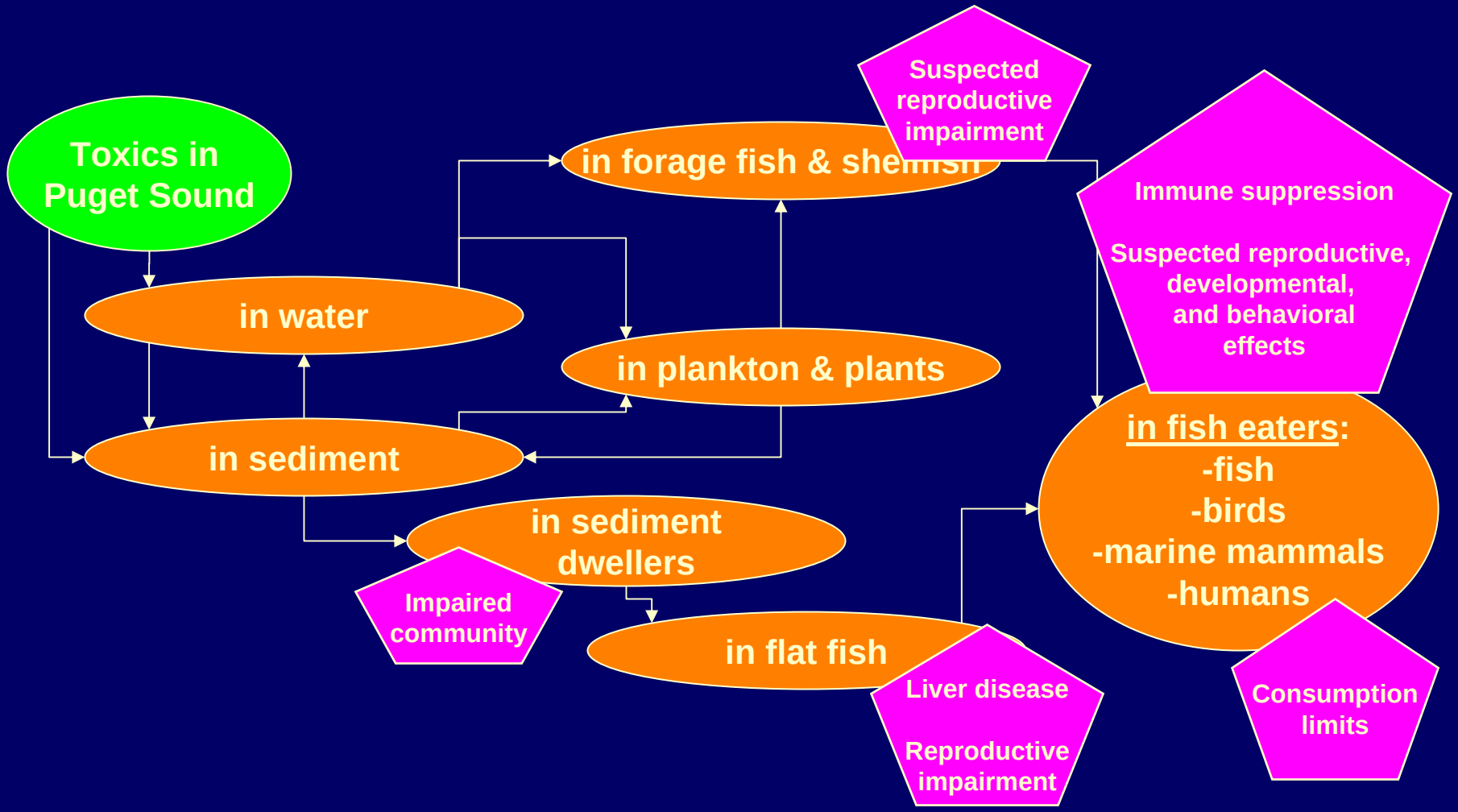
Fish and wildlife harm from other toxic chemicals

- Pre-spawn mortality of coho salmon returning to urban/developed watersheds apparently related to contaminants in storm flow
  - *NWFSC studies*
- Current use pesticides and other stormwater contaminants, especially copper, may harm salmonids and stream health
  - *NWFSC studies*

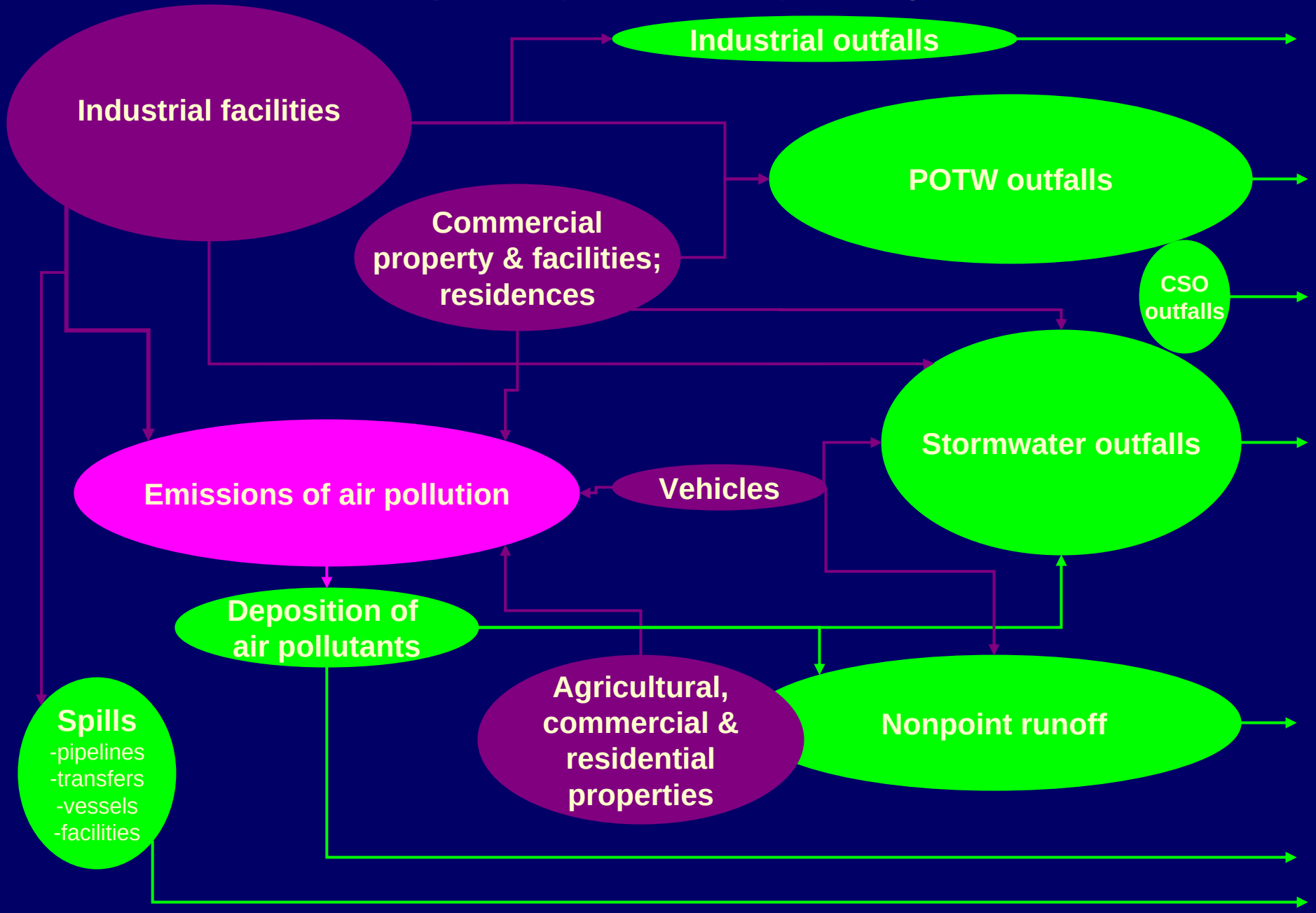
Human health and well-being threatened by toxic chemicals

- Consumption of Puget Sound fish threatens neurological effects, reproductive effects, … in sensitive populations
  - *DOH fish consumption advice*
- Cultural disruptions due to loss of opportunities to harvest and consume Puget Sound seafood
  - *e.g., Swinomish tribal government's evaluation of seafood contamination*

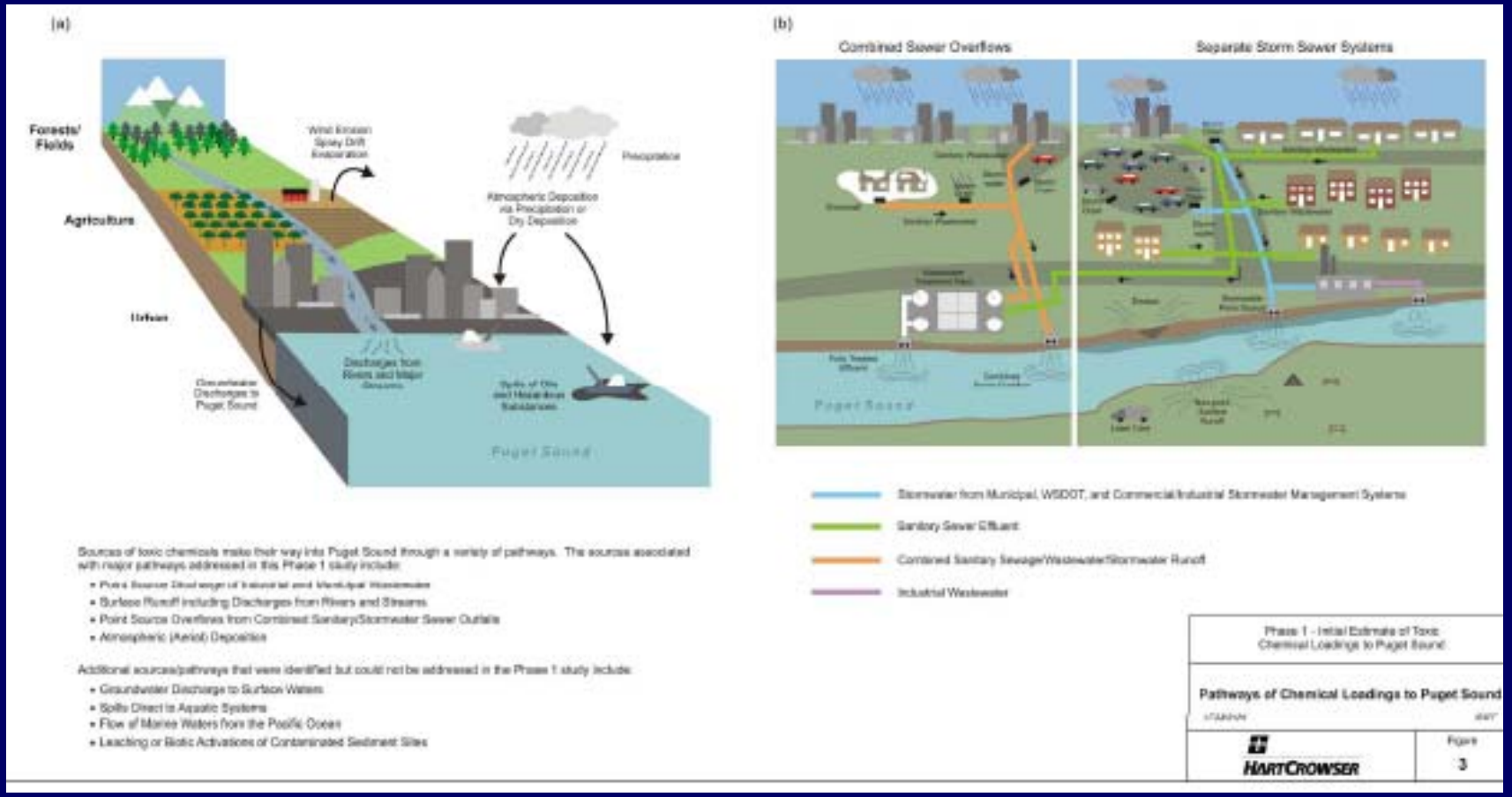
Fate & Effects of Toxic Contamination in Puget Sound



Sources of toxics and pathways of delivery to Puget Sound



Phase 1 Toxics Loading Study



Phase 1 Toxics Loading Study

- Sound-wide Relative Loads
  - Metals and many organics (e.g. lighter PAHs, phthalates, dioxins)

    RUNOFF > ATMOS >> CSOs
  - High molecular weight PAHs

    RUNOFF = ATMOS
  - PBDEs

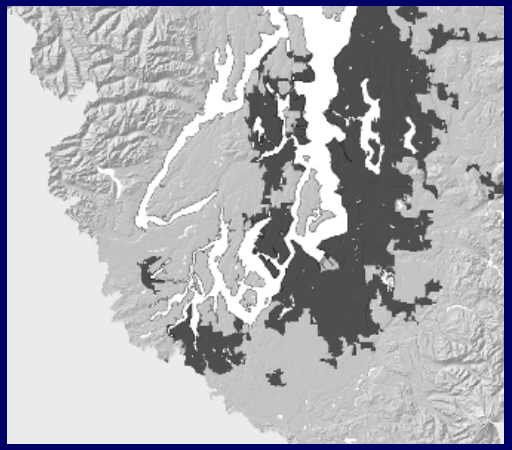
    ATMOS > RUNOFF

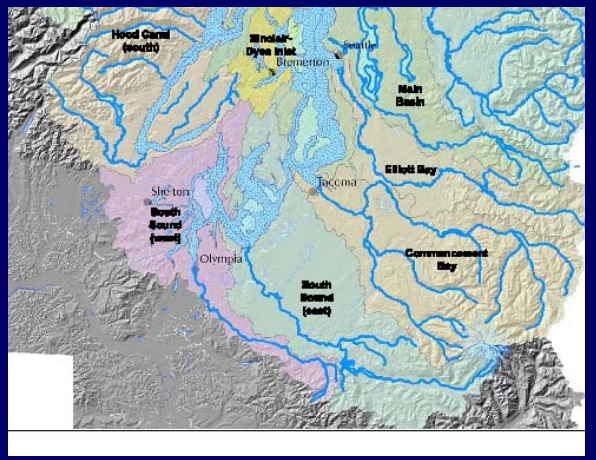
In Phase 1 study,

runoff carries loads from urban and non-urban land

17.5% of South Sound is urban

- Census urbanized areas
- Box model boundary extends north of Tacoma Narrows





Loading via Runoff in South Sound

> 50% from Urban
Oil (59%)
Bis-2-ethylhexyl phthalate
Low molecular weight PAHs
Carcinogenic PAHs
Dioxin toxic equivalents
Cadmium
Other high MW PAHs
Nonylphenol
Zinc
Lead
Total PCBs (54%)

>50% from Nonurban
Mercury (57%)
Copper
Triclopyr
Total PBDEs
Arsenic
Total DDT (87%)

Loading via Runoff in South Sound

Chemical	MT/year in runoff
Oil & Petroleum Products	4,200
Zinc	64
Copper	16
Lead	16
BEHP	12
Nonylphenol	1.5
Low MW PAHs	1.1

Municipal Wastewater Treatment Plants

Draft report on mixing zones (Trim et al. 2007)

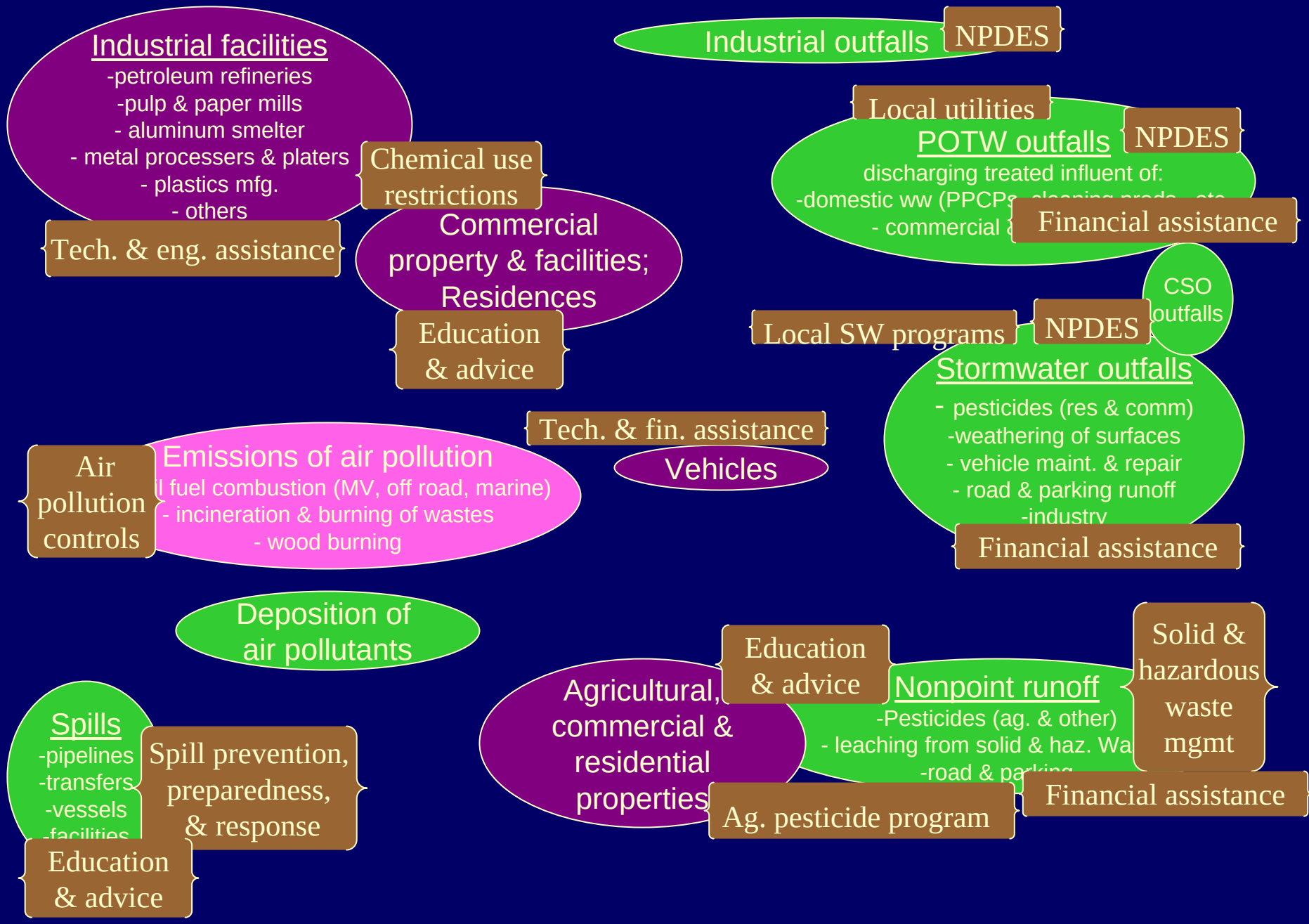
FACILITY	Average Flow (mgd)
Chambers Creek	16
LOTT	12
Fort Lewis	3.2
Shelton	2.7
Eatonville	0.45
Yelm	0.4
McNeil Island	0.38
Hartstene Pointe	0.17
Rustlewood	0.15
Tamoshan	0.04
Boston Harbor	0.032
Seashore Villa	0.02
Carlyon Beach	0.019
Taylor Bay	0.006

- Total flow = 36 MGD
  - *About 9% of Puget Sound total*
- Load = 1/20 or 1/30 of runoff
  - Zinc = 2.3 MT/y
  - Copper = 0.8 MT/y
  - BEHP = 0.4 MT/y
  - Lead = 0.3 MT/y

Sound-wide major industrial facilities

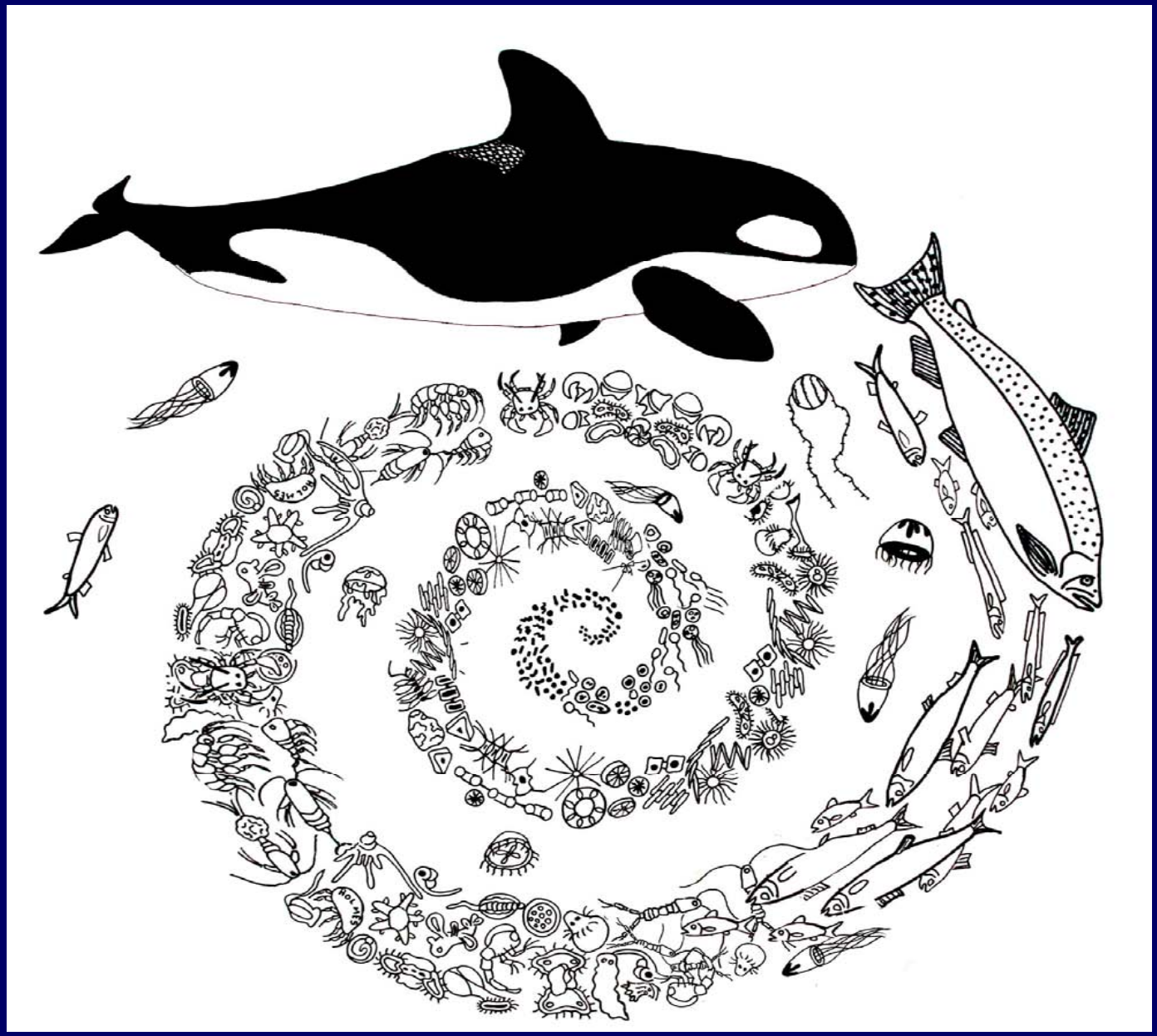
- *30% of WWTP flow*
- *n=0 in South Puget Sound*

Controls on introduction of toxic chemicals to Puget Sound



Strategies for 2007-09

1. Reduce the use and generation of toxic chemicals
2. Reduce the release of toxic chemicals to the environment
3. Improve spill prevention and response
4. Educate residents to change behavior to reduce toxic contamination
5. Study toxics in Puget Sound



Puget Sound Plankton - The Ultimate Seafood Experience, Jan Holmes